CLAIMS

What is claimed is:

1. A process of manufacturing a filled rubber comprising the steps of mixing a rubber, an inorganic filler, and a blocked mercaptosilane selected from the group consisting of:

$[[(ROC(=O))_p\text{-}(G)_j]_k\text{-}Y\text{-}S]_r\text{-}G\text{-}(SiX_3)_s$ (1); and

$[(X_3Si)_q\text{-}G]_a\text{-}[Y\text{-}[S\text{-}G\text{-}SiX_3]_b]_c$ (2)

wherein

Y is a polyvalent species $(Q)_zA(=E)$ selected from the group consisting of -C(=NR)-;-SC(=NR)-; -SC(=O)-; -OC(=O)-; -S(=O)-; -S(=O)$_2$-; -OS(=O)$_2$-; (-NR)S(=O)$_2$-; -SS(=O)-; -OS(=O)-; (-NR)S(=O)-; -SS(=O)$_2$-; (-S)$_2$P(=O)-; -(-S)P(=O)-; -P(=O)(-)$_2$; (-S)$_2$P(=S)-; -(-S)P(=S)-; -P(=S)(-)$_2$; (-NR)$_2$P(=O)-; (-NR)(-S)P(=O)-; (-O)(-NR)P(=O)-; (-O)(-S)P(=O)-; (-O)$_2$P(=O)-; -(-O)P(=O)-; -(-NR)P(=O)-; (-NR)$_2$P(=S)-; (-NR)(-S)P(=S)-; (-O)(-NR)P(=S)-; (-O)(-S)P(=S)-; (-O)$_2$P(=S)-; -(-O)P(=S)-; and -(-NR)P(=S)-; wherein the atom A, attached to the unsaturated heteroatom E, is attached to the sulfur which in turn is linked via a group G to the silicon atom;

each R is chosen independently from hydrogen, straight, cyclic, or branched alkyl that may or may not contain unsaturation, alkenyl groups, aryl groups, and aralkyl groups, with each R containing from 1 to 18 carbon atoms;

each G is independently a monovalent or polyvalent group derived by substitution of alkyl, alkenyl, aryl, or aralkyl wherein G can contain from 1 to 18 carbon atoms, with the proviso that G is not such that the blocked mercaptosilane would contain an α,β-unsaturated carbonyl that can undergo polymerization reactions, and if G is univalent, G can be a hydrogen atom;

X is independently selected from the group consisting of -Cl, -Br, RO-, RC(=O)O-, R_2C=NO-, R_2NO-, R_2N-, -R, and -$(OSiR_2)_j(OSiR_3)$ wherein each R is as above and at least one X is not -R;

p is 0 to 5; r is 1 to 3; z is 0 to 2; q is 0 to 6; a is 0 to 7; b is 1 to 3; j is 0 to 1, but it may be 0 only if p is 1; c is 1 to 6; t is 0 to 5; s is 1 to 3; k is 1 to 2; with the provisos that (I) if A is carbon, sulfur, or sulfonyl, then (i) a + b is 2 and (ii) k is 1; (II) if A is phosphorus, then a + b is 3 unless both (i) c is greater than 1 and (ii) b is 1, in which case a is c + 1; and (III) if A is phosphorus, then k is 2;

to produce a rubber mixture;

mixing into the rubber mixture (i) a deblocking agent to deblock the blocked mercaptosilane, and (ii) a curing agent; and

allowing the rubber mixture to cure.

2. The process of claim 1 wherein each R of the blocked mercaptosilane is selected from the group consisting of methyl, ethyl, propyl, isobutyl, phenyl, tolyl, phenethyl, norbornyl, norbornenyl, ethylnorbornyl, ethylnorbornenyl, ethylcyclohexyl, ethylcyclohexenyl, and cyclohexylcyclohexyl.

3. The process of claim 1 wherein the blocked mercaptosilane has the formula:

$$[[(ROC(=O))_p\text{-}(G)_j]_k\text{-}Y\text{-}S]_r\text{-}G\text{-}(SiX_3)_s \, .$$

4. The process of claim 1 wherein the blocked mercaptosilane has the formula:

$$[(X_3Si)_q\text{-}G]_a\text{-}[Y\text{-}[S\text{-}G\text{-}SiX_3]_b]_c \, .$$

5. The process of claim 1 wherein the blocked mercaptosilane is partially hydrolyzed.

6. The process of claim 1 wherein Y of the blocked mercaptosilane is selected from the group consisting of -OC(=O)-; -S(=O)-; -S(=O)-; -(-S)P(=O)-; and $-P(=O)(-)_2$.

7. The process of claim 1 wherein each G of the blocked mercaptosilane is independently a monovalent or polyvalent group derived by substitution of alkyl, alkenyl, aryl, or aralkyl wherein the sum of all carbon atoms within G groups is three to eighteen carbon atoms.

8. The process of claim 1 wherein each G of the blocked mercaptosilane is independently a monovalent or polyvalent group derived by substitution of alkyl, alkenyl, aryl, or aralkyl wherein the sum of all carbon atoms within G groups is six to fourteen carbon atoms.

9. The process of claim 1 wherein X of the blocked mercaptosilane is independently selected from the group consisting of methoxy, ethoxy, isobutoxy, propoxy, isopropoxy, acetoxy, and oximato.

10. A process of manufacturing a filled rubber comprising the steps of:

mixing a rubber, an inorganic filler, and a blocked mercaptosilane selected from the group consisting of:

$$[[(ROC(=O))_p\text{-}(G)_j]_k\text{-}Y\text{-}S]_r\text{-}G\text{-}(SiX_3)_s \quad (1); \text{ and}$$

$$[(X_3Si)_q\text{-}G]_a\text{-}[Y\text{-}[S\text{-}G\text{-}SiX_3]_b]_c \quad (2)$$

wherein

Y is a polyvalent species $(Q)_zA(=E)$ selected from the group consisting of -C(=NR)-;-SC(=NR)-; -SC(=O)-; -OC(=O)-; -S(=O)-; -S(=O)$_2$-; -OS(=O)$_2$-; (-NR)S(=O)$_2$-; -SS(=O)-; -OS(=O)-; (-NR)S(=O)-; -SS(=O)$_2$-; (-S)$_2$P(=O)-; -(-S)P(=O)-; -P(=O)(-)$_2$; (-S)$_2$P(=S)-; -(-S)P(=S)-; -P(=S)(-)$_2$; (-NR)$_2$P(=O)-; (-NR)(-S)P(=O)-; (-O)(-NR)P(=O)-; (-O)(-S)P(=O)-; (-O)$_2$P(=O)-; -(-O)P(=O)-; -(-NR)P(=O)-; (-NR)$_2$P(=S)-; (-NR)(-S)P(=S)-; (-O)(-NR)P(=S)-; (-O)(-S)P(=S)-; (-O)$_2$P(=S)-; -(-O)P(=S)-; and -(-NR)P(=S)-; wherein the atom A, attached to the unsaturated heteroatom E, is attached to the sulfur which in turn is linked via a group G to the silicon atom;

each R is selected from the group consisting of hydrogen, phenyl, isopropyl, cyclohexyl, and isobutyl;

each G is a substituted phenyl or substituted straight chain alkyl having from 2 to 12 carbon atoms;

X is independently selected from the group consisting of RO- and RC(=O)O-, wherein each R is as above;

p is 0 to 2; r is 1 to 3; z is 0 to 2; q is 0 to 6; a is 0 to 7; b is 1 to 3; j is 0 to 1, but it may be 0 only if p is 1; c is 1 to 6; t is 0 to 5; s is 1 to 3; k is 1 to 2; with the provisos that (I) if A is carbon, sulfur or sulfonyl, then (i) a + b is 2 and (ii) k is 1; (II) if A is phosphorus, then a + b is 3 unless both (i) c is greater than 1 and (ii) b is 1, in which case a is c + 1; and (III) if A is phosphorus, then k is 2;

to produce a rubber mixture;

mixing into the rubber mixture (i) a deblocking agent to deblock the blocked mercaptosilane, and (ii) a curing agent; and

allowing the rubber mixture to cure.

11. A process for the manufacture of a filled rubber comprising the steps of mixing a rubber, an inorganic filler, and a blocked mercaptosilane selected from the group consisting of:

$$[[(ROC(=O))_p\text{-}(G)_j]_k\text{-}Y\text{-}S]_r\text{-}G\text{-}(SiX_3)_s \quad (1); \text{ and}$$

$$[(X_3Si)_q\text{-}G]_a\text{-}[Y\text{-}[S\text{-}G\text{-}SiX_3]_b]_c \quad (2)$$

wherein

Y is -C(=O)-;

R is hydrogen or an alkyl having from one to four carbon atoms;

each G is a substituted phenyl or an alkyl derivative having from 2 to 12 carbon atoms, with the proviso that G is not such that the mercaptosilane would contain an α,β-unsaturated carbonyl that can undergo polymerization reactions;

X is independently a group selected from the group consisting of -Cl, -Br, RO-, RC(=O)O-, R_2C=NO-, R_2NO-, R_2N-, -R, and $-(OSiR_2)_t(OSiR_3)$ wherein each R and G is as above and at least one X is not -R; and

p is 2 to 5; r is 1 to 3; q is 0 to 6; a is 0 to 7; b is 1 to 2; j is 1; c is 1 to 6; t is 0 to 5; s is 1 to 3; k is 1; and a + b is 2;

to produce a rubber mixture;

mixing into the rubber mixture (i) a deblocking agent to deblock the blocked mercaptosilane, and (ii) a curing agent; and

allowing the rubber mixture to cure.

12. The process of claim 11 wherein the blocked mercaptosilane is partially hydrolyzed.

13. The process of claim 11 wherein X of the blocked mercaptosilane is selected from the group consisting of methoxy, ethoxy, isobutoxy, propoxy, isopropoxy, acetoxy, and oximato.

14. The process of claim 11 wherein X of the blocked mercaptosilane is RO- or RC(=O)O-.

15. The process of claim 11 wherein R of the blocked mercaptosilane is hydrogen.

16. The process of claim 11 wherein G of the blocked mercaptosilane is a substituted phenyl.

17. The process of claim 1 wherein G, which is directly bonded to Y, is alkyl of two to twelve carbon atoms.

18. The process of claim 1 wherein G, which is directly bonded to Y, is alkyl of six to eight carbon atoms.

19. A process for the manufacture of a filled rubber comprising the steps of mixing a rubber, an inorganic filler, and a blocked mercaptosilane of the formula:

$$X_3SiGSC(=O)GC(=O)SGSiX_3$$

wherein

each R is chosen independently from hydrogen, straight, cyclic, or branched alkyl that may or may not contain unsaturation, alkenyl groups, aryl groups, and aralkyl groups, with each R containing from 1 to 18 carbon atoms;

each G is independently a divalent group derived by substitution of alkyl, alkenyl, aryl, or aralkyl, wherein G can contain from 1 to 18 carbon atoms, with the proviso that G is not such that the blocked mercaptosilane would contain an α,β-unsaturated carbonyl including a carbon-carbon double bond next to the thiocarbonyl group;

X is independently selected from the group consisting of -Cl, -Br, RO-, RC(=O)O-, R_2C=NO-, R_2NO-, R_2N-, -R, and $-(OSiR_2)_t(OSiR_3)$ wherein each R is as above and at least one X is not -R; and

t is 0 to 5;

to produce a rubber mixture;

mixing into the rubber mixture (i) a deblocking agent to deblock the blocked mercaptosilane, and (ii) a curing agent; and

allowing the rubber mixture to cure.

20. A filled rubber produced by a process comprising the steps of mixing a rubber, an inorganic filler, and a blocked mercaptosilane selected from the group consisting of:

$$[[(ROC(=O))_p\text{-}(G)_j]_k\text{-}Y\text{-}S]_r\text{-}G(SiX_3)_s \qquad (1); \text{ and}$$

$$[(X_3Si)_q\text{-}G]_s\text{-}[Y\text{-}[S\text{-}G\text{-}SiX_3]_b]_c \qquad (2)$$

wherein

Y is a polyvalent species $(Q)_zA(=E)$, each wherein the atom A attached to the unsaturated heteroatom E is attached to the sulfur, which in turn is linked via a group G to the silicon atom;

each R is chosen independently from hydrogen, straight, cyclic, or branched alkyl that may or may not contain unsaturation, alkenyl groups, aryl groups, and aralkyl groups, with each R containing from 1 to 18 carbon atoms;

each G is independently a monovalent or polyvalent group derived by substitution of alkyl, alkenyl, aryl, or aralkyl wherein G can contain from 1 to 18 carbon atoms, with the proviso that if Y is -C(=O)-, G is not such that the blocked mercaptosilane would contain an α,β-unsaturated carbonyl, and if G is univalent, G can be a hydrogen atom;

X is independently a group selected from the group consisting of -Cl, -Br, RO-, RC(=O)O-, R_2C=NO-, R_2NO-, R_2N-, -R, and $-(OSiR_2)_j(OSiR_3)$ wherein each R is as above and at least one X is not -R;

Q is oxygen, sulfur, or (-NR-);

A is carbon, sulfur, phosphorus, or sulfonyl;

E is oxygen, sulfur, or NR;

p is 0 to 5; r is 1 to 3; z is 0 to 2; q is 0 to 6; a is 0 to 7; b is 1 to 3; j is 0 to 1, but it may be 0 only if p is 1; c is 1 to 6; t is 0 to 5; s is 1 to 3; k is 1 to 2, with the provisos that (A) if A is carbon, sulfur, or sulfonyl, then (i) a + b is 2 and (ii) k is 1; (B) if A is phosphorus, then a + b is 3 unless both (i) c is greater than 1 and (ii) b is 1, in which case a is c + 1; and (C) if A is phosphorus, then k is 2;

to produce a rubber mixture;

mixing into the rubber mixture (i) a deblocking agent to deblock the blocked mercaptosilane, and (ii) a curing agent; and

allowing the rubber mixture to cure.

21. The filled rubber of claim 20 wherein each R of the blocked mercaptosilane is selected from the group consisting of methyl, ethyl, propyl, isobutyl, phenyl, tolyl, phenethyl, norbornyl, norbornenyl, ethylnorbornyl, ethylnorbornenyl, ethylcyclohexyl, ethylcyclohexenyl, and cyclohexylcyclohexyl.

22. The filled rubber of claim 20 wherein the blocked mercaptosilane has the formula:

$$[[(ROC(=O))_p\text{-}(G)_j]_k\text{-}Y\text{-}S]_r\text{-}G(SiX_3)_s \ .$$

23. The filled rubber of claim 20 wherein the blocked mercaptosilane has the formula:

$$[(X_3Si)_q\text{-}G]_a\text{-}[Y\text{-}[S\text{-}G\text{-}SiX_3]_b]_c.$$

24. The filled rubber of claim 20 wherein the blocked mercaptosilane is partially hydrolyzed.

25. The filled rubber of claim 20 wherein Y of the blocked mercaptosilane is selected from the group consisting of -C(=NR)-;-SC(=NR)-; -SC(=O)-; -OC(=O)-; -S(=O)-; -$S(=O)_2$-; -$OS(=O)_2$-; (-NR)S(=O)$_2$-; -SS(=O)-; -OS(=O)-; (-NR)S(=O)-; -$SS(=O)_2$-; (-$S)_2$P(=O)-; -(-S)P(=O)-; -P(=O)(-)$_2$; (-$S)_2$P(=S)-; -(-S)P(=S)-; -P(=S)(-)$_2$; (-$NR)_2$P(=O)-; (-NR)(-S)P(=O)-; (-O)(-NR)P(=O)-; (-O)(-S)P(=O)-; (-$O)_2$P(=O)-; -(-O)P(=O)-;

-(-NR)P(=O)-; $(-NR)_2P(=S)$-; (-NR)(-S)P(=S)-; (-O)(-NR)P(=S)-; (-O)(-S)P(=S)-; $(-O)_2P(=S)$-; -(-O)P(=S)-; and -(-NR)P(=S)-.

26. The filled rubber of claim 20 wherein each G of the blocked mercaptosilane is independently a monovalent or polyvalent group derived by substitution of alkyl, alkenyl, aryl, or aralkyl wherein the sum of all carbon atoms within G groups is three to eighteen carbon atoms.

27. The filled rubber of claim 20 wherein each G of the blocked mercaptosilane is independently a monovalent or polyvalent group derived by substitution of alkyl, alkenyl, aryl, or aralkyl wherein the sum of all carbon atoms within G groups is six to fourteen carbon atoms.

28. The filled rubber of claim 20 wherein X of the blocked mercaptosilane is independently selected from the group consisting of methoxy, ethoxy, isobutoxy, propoxy, isopropoxy, acetoxy, and oximato.

29. The filled rubber of Claim 20 wherein the blocked mercaptosilane is selected from the group consisting of:

2-triethoxysilyl-1-ethyl thioacetate; 2-trimethoxysilyl-1-ethyl thioacetate;
2-(methyldimethoxysilyl)-1-ethyl thioacetate; 3-trimethoxysilyl-1-propyl thioacetate;
triethoxysilylmethyl thioacetate; trimethoxysilylmethyl thioacetate; triisopropoxysilylmethyl thioacetate; methyldiethoxysilylmethyl thioacetate; methyldimethoxysilylmethyl thioacetate;

methyldiisopropoxysilylmethyl thioacetate; dimethylethoxysilylmethyl thioacetate; dimethylmethoxysilylmethyl thioacetate; dimethylisopropoxysilylmethyl thioacetate; 2-triisopropoxysilyl-1-ethyl thioacetate; 2-(methyldiethoxysilyl)-1-ethyl thioacetate; 2-(methyldiisopropoxysilyl)-1-ethyl thioacetate; 2-(dimethylethoxysilyl-1-ethyl thioacetate; 2-(dimethylmethoxysilyl)-1-ethyl thioacetate; 2-(dimethylisopropoxysilyl)-1-ethyl thioacetate; 3-triethoxysilyl-1-propyl thioacetate; 3-triisopropoxysilyl-1-propyl thioacetate; 3-methyldiethoxysilyl-1-propyl thioacetate; 3-methyldimethoxysilyl-1-propyl thioacetate; 3-methyldiisopropoxysilyl-1-propyl thioacetate; 1-(2-triethoxysilyl-1-ethyl)-4-thioacetylcyclohexane; 1-(2-triethoxysilyl-1-ethyl)-3-thioacetylcyclohexane; 2-triethoxysilyl-5-thioacetylnorbornene; 2-triethoxysilyl-4-thioacetylnorbornene; 2-(2-triethoxysilyl-1-ethyl)-5-thioacetylnorbornene; 2-(2-triethoxysilyl-1-ethyl)-4-thioacetylnorbornene; 1-(1-oxo-2-thia-5-triethoxysilylpenyl)benzoic acid; 6-triethoxysilyl-1-hexyl thioacetate; 1-triethoxysilyl-5-hexyl thioacetate; 8-triethoxysilyl-1-octyl thioacetate; 1-triethoxysilyl-7-octyl thioacetate; 6-triethoxysilyl-1-hexyl thioacetate; 1-triethoxysilyl-5-octyl thioacetate; 8-trimethoxysilyl-1-octyl thioacetate; 1-trimethoxysilyl-7-octyl thioacetate; 10-triethoxysilyl-1-decyl thioacetate; 1-triethoxysilyl-9-decyl thioacetate; 1-triethoxysilyl-2-butyl thioacetate; 1-triethoxysilyl-3-butyl thioacetate; 1-triethoxysilyl-3-methyl-2-butyl thioacetate; 1-triethoxysilyl-3-methyl-3-butyl thioacetate; 3-trimethoxysilyl-1-propyl thiooctanoate; 3-triethoxysilyl-1-propyl-1-propyl thiopalmitate; 3-triethoxysilyl-1-propyl thiooctanoate; 3-triethoxysilyl-1-propyl thiobenzoate; 3-triethoxysilyl-1-propyl thio-2-ethylhexanoate; 3-methyldiacetoxysilyl-1-propyl thioacetate; 3-triacetoxysilyl-1-propyl thioacetate; 2-methyldiacetoxysilyl-1-ethyl thioacetate; 2-triacetoxysilyl-1-ethyl thioacetate; 1-methyldiacetoxysilyl-1-ethyl thioacetate; 1-triacetoxysilyl-1-ethyl thioacetate; tris-(3-triethoxysilyl-1-propyl)trithiophosphate;

bis-(3-triethoxysilyl-1-propyl)methyldithiophosphonate; bis-(3-triethoxysilyl-1-propyl)ethyldithiophosphonate; 3-triethoxysilyl-1-propyldimethylthiophosphinate; 3-triethoxysilyl-1-propyldiethylthiophosphinate; tris-(3-triethoxysilyl-1-propyl)tetrathiophosphate; bis-(3-triethoxysilyl-1-propyl)methyltrithiophosphonate; bis-(3-triethoxysilyl-1-propyl)ethyltrithiophosphonate; 3-triethoxysilyl-1-propyldimethyldithiophosphinate; 3-triethoxysilyl-1-propyldiethyldithiophosphinate; tris-(3-methyldimethoxysilyl-1-propyl)trithiophosphate; bis-(3-methyldimethoxysilyl-1-propyl)methyldithiophosphonate; bis-(3-methyldimethoxysilyl-1-propyl)ethyldithiophosphonate; 3-methyldimethoxysilyl-1-propyldimethylthiophosphinate; 3-methyldimethoxysilyl-1-propyldiethylthiophosphinate; 3-triethoxysilyl-1-propylmethylthiosulphate; 3-triethoxysilyl-1-propylmethanethiosulphonate; 3-triethoxysilyl-1-propylethanethiosulphonate; 3-triethoxysilyl-1-propylbenzenethiosulphonate; 3-triethoxysilyl-1-propyltoluenethiosulphonate; 3-triethoxysilyl-1-propylnaphthalenethiosulphonate; 3-triethoxysilyl-1-propylxylenethiosulphonate; triethoxysilylmethylmethylthiosulphate; triethoxysilylmethylmethanethiosulphonate; triethoxysilylmethylethanethiosulphonate; triethoxysilylmethylbenzenethiosulphonate; triethoxysilylmethyltoluenethiosulphonate; triethoxysilylmethylnaphthalenethiosulphonate; and triethoxysilylmethylxylenethiosulphonate.

30. A filled rubber produced by a process comprising the steps of:

mixing a rubber, an inorganic filler, and a blocked mercaptosilane selected from the group consisting of:

$$[[(ROC(=O))_p\text{-}(G)_j]_k\text{-}Y\text{-}S]_r\text{-}G(SiX_3)_s \quad (1); \text{ and}$$

$$[(X_3Si)_q\text{-}G]_a\text{-}[Y\text{-}[S\text{-}G\text{-}SiX_3]_b]_c \quad (2)$$

wherein

Y is a polyvalent species $(Q)_zA(=E)$ selected from the group consisting of -C(=NR)-;-SC(=NR)-; -SC(=O)-; -OC(=O)-; -S(=O)-; $-S(=O)_2-$; $-OS(=O)_2-$; $(-NR)S(=O)_2-$; -SS(=O)-; -OS(=O)-; (-NR)S(=O)-; $-SS(=O)_2-$; $(-S)_2P(=O)-$; -(-S)P(=O)-; $-P(=O)(-)_2$; $(-S)_2P(=S)-$; -(-S)P(=S)-; $-P(=S)(-)_2$; $(-NR)_2P(=O)-$; (-NR)(-S)P(=O)-; (-O)(-NR)P(=O)-; (-O)(-S)P(=O)-; $(-O)_2P(=O)-$; -(-O)P(=O)-; -(-NR)P(=O)-; $(-NR)_2P(=S)-$; (-NR)(-S)P(=S)-; (-O)(-NR)P(=S)-; (-O)(-S)P(=S)-; $(-O)_2P(=S)-$; -(-O)P(=S)-; and -(-NR)P(=S)-; wherein the atom A, attached to the unsaturated heteroatom E, is attached to the sulfur which in turn is linked via a group G to the silicon atom;

each R is selected from the group consisting of hydrogen, phenyl, isopropyl, cyclohexyl, and isobutyl;

each G is a substituted phenyl or substituted straight chain alkyl having from 2 to 12 carbon atoms;

X is independently selected from the group consisting of RO- and RC(=O)O-, wherein each R is as above;

p is 0 to 2; r is 1 to 3; z is 0 to 2; q is 0 to 6; a is 0 to 7; b is 1 to 3; j is 0 to 1, but it may be 0 only if p is 1; c is 1 to 6; t is 0 to 5; s is 1 to 3; k is 1 to 2; with the provisos that (I) if A is carbon, sulfur or sulfonyl, then (i) a + b is 2 and (ii) k is 1; (II) if A is phosphorus, then a + b is 3 unless both (i) c is greater than 1 and (ii) b is 1, in which case a is c + 1; and (III) if A is phosphorus, then k is 2;

to produce a rubber mixture;

mixing into the rubber mixture (i) a deblocking agent to deblock the blocked mercaptosilane, and (ii) a curing agent; and

allowing the rubber mixture to cure.

31. A filled rubber produced by a process comprising the steps of mixing a rubber, an inorganic filler, and a blocked mercaptosilane selected from the group consisting of:

$$[[(ROC(=O))_p\text{-}(G)_j]_k\text{-}Y\text{-}S]_r\text{-}G\text{-}(SiX_3)_s \quad (1); \text{ and}$$

$$[(X_3Si)_q\text{-}G]_a\text{-}[Y\text{-}[S\text{-}G\text{-}SiX_3]_b]_c \quad (2)$$

wherein

Y is -C(=O)-;

R is hydrogen or an alkyl having from one to four carbon atoms;

each G is a substituted phenyl or an alkyl derivative having from 2 to 12 carbon atoms, with the proviso that G is not such that the mercaptosilane would contain an α,β-unsaturated carbonyl that can undergo polymerization reactions;

X is independently a group selected from the group consisting of -Cl, -Br, RO-, RC(=O)O-, R_2C=NO-, R_2NO-, R_2N-, -R, and $-(OSiR_2)_t(OSiR_3)$ wherein each R and G is as above and at least one X is not -R; and

p is 2 to 5; r is 1 to 3; q is 0 to 6; a is 0 to 7; b is 1 to 2; j is 1; c is 1 to 6; t is 0 to 5; s is 1 to 3; k is 1; and a + b is 2;

to produce a rubber mixture;

mixing into the rubber mixture (i) a deblocking agent to deblock the blocked mercaptosilane, and (ii) a curing agent; and

allowing the rubber mixture to cure.

32. The filled rubber of claim 31 wherein the blocked mercaptosilane is partially hydrolyzed.

33. The filled rubber of claim 31 wherein X of the blocked mercaptosilane is selected from the group consisting of methoxy, ethoxy, isobutoxy, propoxy, isopropoxy, acetoxy, and oximato.

34. The filled rubber of claim 31 wherein X of the blocked mercaptosilane is RO- or RC(=O)O-.

35. The filled rubber of claim 31 wherein R of the blocked mercaptosilane is hydrogen.

36. The filled rubber of claim 31 wherein G of the blocked mercaptosilane is a substituted phenyl.

37. The filled rubber of claim 31 wherein G, which is directly bonded to Y, is alkyl of two to twelve carbon atoms.

38. A filled rubber produced by a process comprising the steps of mixing a rubber, an inorganic filler, and a blocked mercaptosilane of the formula:

$$X_3SiGSC(=O)GC(=O)SGSiX_3$$

wherein

each R is chosen independently from hydrogen, straight, cyclic, or branched alkyl that may or may not contain unsaturation, alkenyl groups, aryl groups, and aralkyl groups, with each R containing from 1 to 18 carbon atoms;

each G is independently a divalent group derived by substitution of alkyl, alkenyl, aryl, or aralkyl, wherein G can contain from 1 to 18 carbon atoms, with the proviso that G is not such that the blocked mercaptosilane would contain an α,β-unsaturated carbonyl including a carbon-carbon double bond next to the thiocarbonyl group;

X is independently selected from the group consisting of -Cl, -Br, RO-, RC(=O)O-, R_2C=NO-, R_2NO-, R_2N-, -R, and -$(OSiR_2)_t(OSiR_3)$ wherein each R is as above and at least one X is not -R; and

t is 0 to 5;

to produce a rubber mixture;

mixing into the rubber mixture (i) a deblocking agent to deblock the blocked mercaptosilane, and (ii) a curing agent; and

allowing the rubber mixture to cure.